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THE PLANT DISEASE REPORTER

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Supplement 115

A Summary of the Cereal Rust Situation in Virginia in 1938

With Notes on Other Cereal Diseases

October 1, 1939

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

A SUMMARY OF THE CEREAL RUST SITUATION IN VIRGINIA IN 1938

WITH NOTES ON OTHER CEREAL DISEASES

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Plant Disease Reporter
Supplement 115 October 1, 1939

Stem Rust

The pycnial and aecial stages of stem rust (Puccinia graminis Pers.) of grains and grasses were observed on the native American barberry (Berberis canadensis Mill.) in Virginia 11 and 14 days earlier in 1938 than had been previously reported. Pycnial infection was first observed on April 8, and aecia on April 15. Uredial infection was first observed on wheat on May 9, which is 11 days earlier than previously reported; on barley on May 11, which is 10 days earlier; on rye on June 4, which is about normal; and on oats on June 4, which is 4 days earlier than previously observed (Table 1).

Table 1.
Dates of appearance in Virginia of various stages of the cereal rusts on barberry, wheat, oats, rye, and barley for the years 1934-38, inclusive

	Barberry		Wheat		Oats		Rye		Barley	
Year	Pycnial	Aecial	Stem	Leaf	Stem	Crown	Stem	Leaf	Stem	Leaf
1934	Apr.24	May 10	May 29	May 23	July 5	May 25	June 11	May 23	Jun.2	May 23
1935	Apr.27	May 4	May 23	May 9	June 29	May 22	May 28	May 28	Jun.6	May 10
1936	Apr.22	Apr.29	May 20	May 20	July 11	May 23	May 30	May 19	May 21	May 16
1937	Apr.19	May 3	May 27	May 3	June 15	May 20	June 3	May 10	May 28	May 3
1938	Apr. 8	Apr.15	May 9	Apr.15	June 11	May 21	June 4	Apr.19	May 11	May 4

An interesting and direct correlation has been found to exist between temperature and moisture conditions in April, May, and June and the dates on which the various stages of stem and leaf rusts have been observed on the different host plants since 1934, the earliest date of our records.

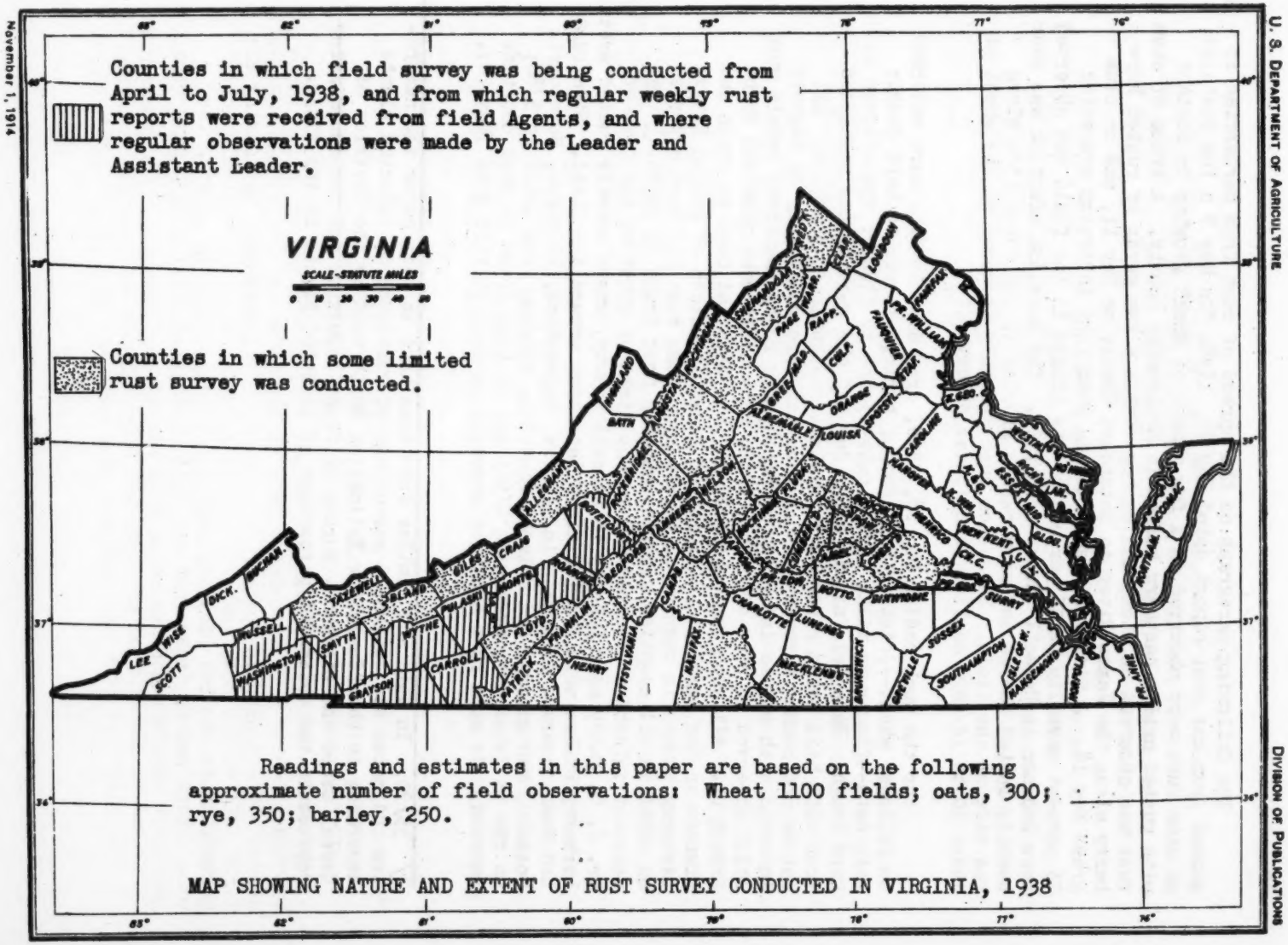
The early appearance of both stem rust and the leaf rusts in Virginia in 1938 appears to have been due largely to unusually favorable moisture and temperature conditions during the early part of the growing season. Table 2 summarizes weather information for the period March to July inclusive.

Table 2.

Precipitation and temperature data recorded by the U.S. Weather Bureau at Wytheville and by the Virginia Agricultural Experiment Station at Blacksburg, for March, April, May, June, and July, 1938.

	Precipitation		Temperature		
	Wytheville	Blacksburg	Wytheville		Blacksburg
	Ins.	Ins.	Mean	Normal	Mean
March	2.67	2.18	49°F.	42°F.	49°F.
April	2.77	2.33	53	52	53
May	6.45	5.04	61	62	61
June	2.65	4.54	66	69	67
July	8.02	8.42	73	72	72

In our rust report of May 21, 1938, which was the first report prepared by this office for the year, the following weather conditions were noted: "The season in April was about two weeks advanced, but during the first half of May both temperature and rainfall were considerably below normal. Hail was reported in several mountain sections. During the week ending May 21, there has been almost daily rainfall; days have been generally warmer and nights continued cool."


Counties in which field survey was being conducted from April to July, 1938, and from which regular weekly rust reports were received from field Agents, and where regular observations were made by the Leader and Assistant Leader.
VIRGINIA
SCALE-STATUTE MILES
0 10 20 30 40 50
Counties in which some limited rust survey was conducted.
Readings and estimates in this paper are based on the following approximate number of field observations: Wheat 1100 fields; oats, 300; rye, 350; barley, 250.
MAP SHOWING NATURE AND EXTENT OF RUST SURVEY CONDUCTED IN VIRGINIA, 1938

November 1, 1914

U. S. Department of Agriculture

Division of Publications

The following paragraph on the spread of rust from barberries is quoted from our rust report dated May 21, 1938: "On May 9 a few pustules of stem rust were observed on a few plants of wheat growing in contact with rusted native barberry bushes in Montgomery County. A trace of stem rust was observed on wheat and barley within a few yards of rusted barberry along the James River in Botetourt County on May 11, and on blue grass May 18. A field of wheat showing stem rust infection averaging 25 percent severity on 75 percent of the plants in the field was observed near Lebanon in Russell County on May 20. The heaviest infection was near heavily rusted native barberry bushes growing in the fence line along one side of the field. This stem rust probably appeared on the wheat at least 10 to 14 days earlier than it was observed."

For the week ending May 28, 1938, crop developments were recorded as follows: wheat--joint to hard dough; barley--flower to hard dough; fall oats--flower to milk; spring oats--joint to flower; rye--flower to hard dough. Rain fell nearly every day and the weather was continued cool with hail being reported in several southwestern counties. All native and common barberry bushes observed were moderately to heavily infected with the aecial stage of black stem rust. Numerous pycnia were still observed in some sections, while many aecia were observed to be drying up. All stem rust observed at this date had been on grain and grasses in the immediate vicinity of known locations of rusted native barberry bushes in unsurveyed territory. Stem rust had been observed on wheat in all counties covered, ranging from trace to 35/90. 1/ The heaviest infection observed was in one field of wheat on the farm of Mr. J. C. Bundy near Lebanon in Russell County, where heavily rusted native barberry bushes were growing along the fence around the field. Stem rust had been observed on barley in Halifax, Appomattox, Fluvanna, Botetourt, Roanoke, Montgomery, and Pulaski Counties, ranging from trace to 5/80; on rye in Botetourt, averaging T/50; and on blue grass in most counties covered. No stem rust had been observed on oats at this date (May 28).

1/ 35/90. In this and similar fractions used in this paper the numerator indicates the estimated percentage of rustiness of infected plants according to the "Scale for Estimating Rust" used by the Division of Cereal Crops and Diseases, Bureau of Plant Industry, and the denominator represents the estimated percentage of infected plants in the field.

Reports of observations on cereal diseases for the period May 24 to June 2 were made by Assistant State Leader R. S. Mullin for the following counties: Fluvanna, Amelia, Mecklenburg, Halifax, Appomattox, Campbell, Powhatan, and Goochland. Mr. Mullin was employed during this period as a field inspector by the Virginia Crop Improvement Association while on leave from our Bureau. On June 4 Mr. Mullin reported wheat to range from milk to hard-dough stages of development, and barley was in hard-dough stage or harvested. The weather was warm and rainy. Light to moderate stem rust infection was reported at this time. These counties are in the Piedmont section and are out of the present barberry eradication area. Very little is known of the barberry population in these counties.

During the week ending June 4 rain fell nearly every day. The days were quite warm and the nights were cool. Many instances of direct rust-spreads had been observed, the most severe infection being 75/100 on wheat in the immediate vicinity of rusted barberry bushes. Map records being made of all rust observations indicate very definitely that the earliest and most severe stem rust infections are in unsurveyed territory.

During the week ending June 11, the stage of development of wheat, rye and barley was recorded as being from milk to mature; fall oats, milk to dough; and spring oats from joint to flower. Most infection spots on barberry leaves had dried up, but some few new pycnial and aecial infections had been observed.

Near Fincastle in Botetourt County, wheat in a small bottom-field was infected with stem rust ranging from 10 to 75 percent. Several hundred native barberry bushes were growing along a draw in the field, many of them being in immediate contact with the grain plants. Nearly all severe stem rust infections can be traced directly to rusted barberry bushes in the immediate vicinity. In surveyed territory and in comparatively barberry-free sections, stem rust was very light on June 11.

On June 11, most fields of rye had been harvested with no appreciable damage by either stem rust or leaf rust, which appeared late and did not become heavy. Most barley had also been harvested at this time, but the yield and quality of late barley was undoubtedly reduced by both stem and leaf rust. It is estimated that the damage by both was 5 percent or more in many cases.

On June 13, Messrs. W. L. Popham and R. O. Bulger accompanied this reporter on an inspection trip down the Shenandoah Valley from Winchester to Blacksburg through the best wheat-growing sections of Virginia. No readings were recorded for rye in as much as all of this crop had been harvested. No stem rust was observed on oats. Stem rust

infection on wheat and barley observed in the counties covered on June 13 was recorded as shown in Table 3. Observations recorded by Agent R. L. Shaver on an inspection trip on June 25-26 are also shown in Table 3.

Table 3
Stem rust infection on wheat and barley observed
June 13 and June 25-26.

Date	County	Kind of grain	Number of fields	Stage of development	Range of stem rust infection	Observer
June				1/		
13	Frederick	Wheat	4	SD-M	T-2/25-100	(Popham
13	Shenandoah	Wheat	3	MD	T-2/100	Bulger
		Barley	3	M	T/50-100	Matheny)
13	Rockingham	Wheat	4	SD-MD	T/25/100	"
13	Augusta	Wheat	4	MD-HD	T/50-100	"
13	Rockbridge	Wheat	2	SD	T-2/75-100	"
		Barley	1	M	Trace	"
		Orchard grass	1	H	None	"
		Blue grass	1	H	None	"
25	Campbell	Wheat	3	M	40-80/100	Shaver
25	Amherst	Wheat	4	M	40-80/100	"
		Oats	1	MD	None	"
		Rye	1	M	10/100	"
25	Nelson	Wheat	4	M	80-100/100	"
		Oats	2	MD	None	"
25	Albemarle	Wheat	3	M	80-100/100	"
		Oats	2	MD	None	"
26	Augusta	Wheat	4	MD-M	50-80/100	"

1/ SD--soft dough; MD--medium dough; HD--hard dough; M -- mature; H -- heading.

By June 18, practically all barley and rye and most wheat had been harvested. Stem rust had been observed in all fields of wheat, averaging from trace to 10 percent in surveyed territory, and as heavy as 50-100/100 in small fields near rusted barberry bushes. Only a trace of stem rust had been observed on oats at this time.

During the week ending June 25, many interesting observations were made. We quote below paragraph 6, Stem Rust on Grain, from our rust report for this week: "In Wythe County, black stem rust in 12 fields of wheat in territory not surveyed ranged from 10-60/100 to 80-100/100, while in 6 fields of wheat in surveyed territory black stem rust infection averaged from T-10/25 to T-10/90. The range of stem rust infection in 2 fields of wheat in surveyed territory in Montgomery County was T-15/100

and 1-20/100 while in 6 fields of wheat in unsurveyed territory the range of infection was from 1-40/100 to 10-90/100. Similar readings have been obtained in other counties where any considerable amount of territory has been surveyed and barberry eradicated."

In our Rust Damage Forecast of June 25, we stated that rye and barley had been harvested with little or no appreciable damage by stem or leaf rust, except in a few cases. Many fields of wheat were harvested with very little rust damage, while stem rust damage to wheat in other localities will vary from Trace to 50 percent or more. By July 9, all small grains, except a few fields of late spring oats, had been harvested. It was observed that stem rust on spring oats was increasing rapidly, especially in unsurveyed territory. In Montgomery County stem rust in 3 fields of spring oats averaged 15/100. Farmers in northeastern Grayson County report almost complete losses of wheat crops due to stem rust in fields in the immediate vicinity of large numbers of severely rusted native barberry bushes.

On July 16 we submitted our last weekly summary rust report. The warm, rainy weather at that time was very favorable for the rapid development of stem rust on late oats. In some localities, near barberries, stem rust caused severe damage to oats. In surveyed territory infection was observed to be late, general, and comparatively light. Some fields of oats were observed in which stem rust losses were estimated to be as much as 25 percent.

Stem rust damage forecast.-- Most fields of early rye were harvested with little appreciable damage by stem rust, while in several fields of late rye stem rust infection was considerably heavier. It is estimated that the reduction in yield of rye due to stem rust was 1 percent.

Much early barley was harvested with little appreciable damage by stem rust, except in a few cases. However, it is estimated that infection was severe enough in many late fields and in unsurveyed territory so that the reduction in yield due to stem rust would be about 2 percent.

Many fields of winter oats, planted in properly prepared and fertilized seedbeds, will suffer very little from stem rust damage. However, in many fields of late spring oats in unsurveyed territory, it is estimated that losses were as much as 25 percent. It is estimated that the average reduction in yield of all oats due to stem rust damage was about 4 percent.

Early-maturing wheat in surveyed territory and in some of the Valley counties was harvested with little appreciable damage by stem rust. However, in unsurveyed territory in southwestern Virginia and in many

sections of the more important wheat-producing part of the State, stem rust was responsible for severe losses. After supplementing our rust observations in the field with available yield and weight data, it is estimated that the reduction in yield of wheat in 1938 due to stem rust was 5 percent.

Leaf Rusts

The same weather conditions which favored the early development of stem rust were also an important factor in the appearance of leaf rust (Puccinia triticina) on wheat on April 15, which is 18 days earlier than observed previously. Moderately heavy leaf rust (P. dispersa) infection was observed on rye on April 19. A trace of leaf rust (P. agropyri) was reported on bluegrass in Pulaski County on April 20. By May 7, leaf rust was general and of moderate severity in all counties on wheat, rye, and barley. By this date moderate infections had been reported on 10 different varieties of winter wheat in the Chilhowie rust nursery. A light infection of crown rust (P. coronata avenae) on oats was first reported in Roanoke and Botetourt Counties on May 21.

Leaf rust of barley (P. anomala) and of wheat, ranging from 5/75 to 65/100 had been observed in most fields by May 28. This rapid development of leaf rust was promoted by the heavy rainfall and favorable temperature which prevailed during May 1938.

By June 11, only light infections of leaf rust were observed on rye in early fields, whereas late rye showed leaf rust as heavy as 50-65/100. At this time 100 percent leaf rust infection was observed on barley, while on wheat it ranged from 10-100/100. A trace of crown rust was observed on fall oats, while all spring oats observed were still free from infection. By June 25 crown rust of oats had increased rapidly in severity, some fields showing an infection as heavy as 10-75/100. At the time of harvest 100 percent crown rust infection was observed in many fields of late-maturing spring oats.

Leaf rust damage forecast.--Estimates of reduction in yield for the small-grain crops attributable to leaf rusts are as follows:

Rye 1 percent; Barley 3 percent; Oats (crown) 3 percent; Wheat 5 percent.

Notes on Other Cereal Diseases

Incidental to the stem rust survey, in connection with the barberry eradication program, numerous observations on miscellaneous cereal diseases have been made.

The following paragraph is quoted from our Weekly Summary of the Cereal Rust Situation in Virginia for the week ending May 21, 1938:

"Powdery-mildew (Erysiphe graminis) was first observed on wheat on April 15, and has developed rapidly on wheat and barley since that date. Light to moderate loose-smut (Ustilago tritici) infection has been reported on wheat, rye, and barley in all counties observed. Barley stripe (Helminthosporium gramineum) was first observed in Montgomery County on May 2, and is now found generally. One field was observed in which about 20 percent of the plants were infected with stripe. Nematode (Tylenchus tritici) injury has been reported in several counties. It was first observed during the last week in April. One field in Montgomery County shows about 20 percent infestation. Barley-stripe and wheat nematode will cause appreciable damage in many fields. Stem-smut on rye (Urocystis occulta) has been observed in Grayson, Carroll, and Montgomery Counties."

In our weekly rust report for the week ending June 25, the following observations were recorded:

"Heavy rainfall during the past 3 weeks has been favorable for the increase of scab (Gibberella saubinetii), black chaff (Bacterium translucens undulosum), glume blotch (Septoria nodorum), and the various smuts. In many fields infection by these diseases has become quite severe. Fields of wheat have been observed in which wheat nematode has infected as many as 50 percent of the plants.

"The following diseases were observed in one small field of wheat near Speedwell in Wythe County on June 21 by Dr. H. B. Humphrey and this reporter: stem rust, leaf rust, loose smut, bunt, black chaff, Septoria glume blotch, scab, nematode, and powdery mildew. Any wheat that might possibly be harvested from this field will be unfit for milling purposes."